

Glottal Fry in College Aged Females: An Entrainment Phenomenon?

by

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ABSTRACT

Glottal fry is a vocal register characterized by low frequency and increased signal perturbation, and is perceptually identified by its popping, creaky quality. Recently, the use of the glottal fry vocal register has received growing awareness and attention in popular culture and media in the United States. The creaky quality that was originally associated with vocal pathologies is indeed becoming “trendy,” particularly among young women across the United States. But while existing studies have defined, quantified, and attempted to explain the use of glottal fry in conversational speech, there is currently no explanation for the increasing prevalence of the use of glottal fry amongst American women. This thesis, however, proposes that conversational entrainment—a communication phenomenon which describes the propensity to modify one’s behavior to align more closely with one’s communication partner—may provide a theoretical framework to explain the growing trend in the use of glottal fry amongst college-aged women in the United States. Female participants ($n = 30$) between the ages of 18 and 29 years ($M = 20.6$, $SD = 2.95$) had conversations with two conversation partners, one who used quantifiably more glottal fry than the other. The study utilized perceptual and quantifiable acoustic information to address the following key question: Does the amount of habitual glottal fry in a conversational partner influence one’s use of glottal fry in their own speech? Results yielded the following two findings: (1) according to perceptual annotations, the participants used a greater amount of glottal fry when speaking with the Fry conversation partner than with the Non Fry partner, (2) statistically significant differences were found in the acoustics of the participants’ vocal qualities based on conversation partner. While the current study demonstrates that young women are indeed

speaking in glottal fry in everyday conversations, and that its use can be attributed in part to conversational entrainment, we still lack a clear explanation of the deeper motivations for women to speak in a lower vocal register. The current study opens avenues for continued analysis of the sociolinguistic functions of the glottal fry register.

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Glottal Fry

Spoken language carries both linguistic and indexical information. Linguistic information consists of the content of the message, whereas the indexical information is speaker-specific. The latter is influenced by factors that make up one's unique identity, including gender, regional dialect, and emotional state (Nygaard, 2008). One of the most distinctive indexical properties is subserved by all other factors: a speaker's voice. While the aforementioned indexical properties are categorical (e.g. male or female, angry or upset), voice can be quantified on a number of different parameters, including acoustic correlates of rate of speech, pitch, intensity, roughness, and breathiness (Krauss et al., 2001). These features are further modified by internal and external factors including conversational setting, context, circumstance, speaker mood, and communication partner(s) (Krauss et al., 2001). It follows that the qualities of an individual's voice have great effects on what is said and how it is said. It is the use individuals make of their voices that solidifies membership to a certain group (e.g. generation, gender, ethnic group), but also defines them as unique individuals.

One important quality of the voice is pitch. Healthy speakers vary the pitch of their voices across three different registers: modal (the habitual speaking range), falsetto (a higher pitch often used in singing), and the glottal register (below modal, often used at the ends of utterances) (Hollien, Moore, Wendahl, and Michel, 1966). Other terms for the glottal register include "glottal fry" (Hollien and Wendahl, 1968), "creaky voice" (Yuasa, 2010), and "'pulse' register" (Hollien, 1972); and in the field of speech-language pathology "glottal fry" (Wolk, Abdelli-Beruh, & Slavin, 2012). Glottal fry is produced by

increased glottal tension at the level of the vocal folds, which constrains movement of the vocal folds, causing a reduction in periodic vibration. The popping, creaky quality of glottal fry is the result of reduced airflow through the vocal folds and an increase in their mass, leading to a sort of “popping” sound (Sorensen & Horii, 1984). While once thought to be a symptom of a voice disorder, glottal fry is now considered to be “a physiologically normal laryngeal capability,” though not used equally by all individuals (Hollien, et al., 1966). Thus, while this type of creaky vocal quality has been noted in individuals with voice disorders, it is also considered a natural occurrence in healthy individuals, especially evident nearing the end of utterances. Hollien et al. (1966) hypothesize that individuals often produce a wide range of fundamental frequencies, ranging between the modal, falsetto and fry registers. At the same time, however, they suggest that not every individual possesses the vocal range or control necessary to drop into the glottal fry register.

Individuals can recognize glottal fry perceptually by its creaky quality, and it can be detected acoustically using waveform analysis and spectrograms. Much like the irregular movement of the vocal folds during reduced airflow and increased laryngeal tension, glottal fry can be visually detected by its irregular aperiodicity.

Hollien and Michel (1986) performed a study in which 12 male and 11 female participants imitated glottal fry after hearing examples. The investigators concluded from this study that glottal fry is indeed its own vocal register, distinct from the modal register, and that glottal fry register frequency (F0) ranges in males and females were almost identical: 7-78 Hz for males, and 2-78 Hz for females, despite the fact that the male and female participants possessed distinctly different ranges for the modal and falsetto

registers (Hollien and Michel, 1986). A more recent study by Wolk, et al. (2012) identified statistically significant acoustic markers of glottal fry in female's speech across several different parameters: minimum F0, maximum F0, F0 range, and jitter local (defined as perturbation in frequency). These studies demonstrate that, compared to modal speech, glottal fry is characterized by a lower fundamental frequency, and subsequently increased fundamental frequency range, as well as higher levels of signal perturbation, or increased fluctuation in frequency (jitter local) and intensity (shimmer local). Horii (1979) found that individuals speaking in glottal fry, referred as pulse register in the study, had an average jitter of 2.5% and average shimmer values of 1.15 dB compared with modal values of 0.87% and 0.48 dB for jitter and shimmer, respectively.

Recently, the use of the glottal fry register has received growing awareness and attention in popular culture and media in the United States. The creaky quality that was originally associated with vocal pathologies is indeed becoming "trendy," particularly among young women across the United States (Wolk, et al., 2012), as well as by symbols of popular culture, from reality TV shows to singers. Glottal fry has become ubiquitous, and, much like the "valley girl 'upspeak'" of the 1980s (Tamasi and Antieau, 2014), women have begun to receive criticism for speaking in glottal fry (Anderson, et al., 2014).

While the use of glottal fry has been documented in college-aged American men and women, recent studies by Abdelli-Beruh and colleagues (2013) have shown that, at least within controlled experiments, glottal fry is used significantly more in college-aged women than men. Wolk, et al. (2012) and Abdelli-Beruh, et al. (2013) quantified the use of

glottal fry in college-aged females and males between the ages of 18-25 years old, limiting their subjects to native speakers of Standard American English. The experiment consisted of controlled trials: sustained /a/, and a sentence reading task, taken from *The Rainbow Passage*. Results showed that the use of glottal fry in sentences by male speakers was significantly lower than previous results had shown for female subjects, which confirms the media's speculations that glottal fry is primarily a female vocal phenomenon.

Although glottal fry is more prevalent amongst women than men, other questions continue to arise. One such question is that of native language influence: is this creaky voice phenomenon something unique to speakers of Standard American English, or does it span across languages, cultures, and national boundaries? A recent study by Yuasa (2010) analyzed the use of glottal fry cross-linguistically, by quantifying the use of this vocal feature in the conversational speech of young American females and males who were native speakers of Standard American English, and young Japanese women who spoke Japanese, all of whom were residing in the state of California. Yuasa's study revealed that the American women used the highest amount of glottal fry (average 12.4% of words), the Japanese females used the second highest amount (6.9%) and the American men used the least (5.6%). This aligns with Abdelli-Beruh, et al.'s (2013) results showing that females use more creaky voice than males, but also points to a quantifiable trend in the use of glottal fry amongst college-aged women even in conversational speech, as well as the possibility of a predominantly American sociolinguistic trend amongst females. In an attempt to gather more information about the perception of the use of glottal fry, Yuasa also collected subjective data about

individuals' perceptions of the voices of individuals who used glottal fry. Importantly, her results indicated that participants in two distinct parts of the United States (California and Eastern Iowa) reported having heard women in their region utilize glottal fry, suggesting that "creaky voice may be a widespread linguistic phenomenon, increasing among American women of all ages (not just the relatively young ones)" (Yuasa, 2010). Additionally, these survey participants characterized creaky voice by rating a set of pre-selected characteristics, ultimately described creaky voice as sounding "educated," "informal," "genuine," and "nonaggressive" (Yuasa, 2010). But while existing studies have defined, quantified, and attempted to explain the use of glottal fry in conversational speech, there is currently no explanation for the growing trend and the increasing prevalence of the use of glottal fry amongst American women. That is, why and how is glottal fry becoming so popular?

Conversational Entrainment

Entrainment is a unique phenomenon in which communication partners modify their communicative behaviors to more closely resemble one another. Briefly, this is a subconscious process where individuals adapt to auditory and visual input from the surrounding environment. In conversation, auditory input can be characterized by the qualities of our voices, including pitch, intonation, intensity, and register, rate of speech (Levitan & Hirschberg, 2011), and use of pauses (Levitan, Gravano, Willson, Benus, Hirschberg & Nenkova, 2012). The Communication Accommodation Theory (CAT) posits "that individuals engage in entrainment to achieve particular social goals, including social approval or acceptance, attraction, assertion of group or individual identity, and facilitation or regulation of discourse" (Namy, Nygaard, & Sauerteig, 2002). According

to Namy, et al. (2002), individuals monitor the indexical speech characteristics of their interlocutors and either subconsciously or consciously modify their own speech characteristics to better align with, or to be more different from, their interlocutor's. The ways in which the individual alters his or her speech is influenced by a great number of variables, from the situational context to the person's gender (Namy, et al., 2002), and can either serve to create a stronger connection, or greater misconnection, between them. The CAT therefore is a theoretical framework that explains possible reasons for which individuals entrain during conversation, whether intentionally or subconsciously.

Our ability to align our communication styles subconsciously with the people around us affords us a sense of unity and understanding that otherwise would not be possible. Beneath these sociolinguistic motivations to align our communication with others, however, lie our innate neurological systems, which support our perceptions of and reactions to incoming stimulus on a number of levels. It is this system which enables us to align features such as our use of gestures, rate of speech, use of intonation, and, most relevant, glottal fry, therefore shaping our interactions with our communication partners. We propose that the increase in the use of glottal fry amongst American women is the result of a desire (whether conscious or not) to entrain with their conversation partners, as a means of assimilating into a larger sociolinguistic identity.

Current Study

The current study investigated conversational entrainment as the theoretical framework to explain the increasing prevalence of glottal fry amongst college-aged women in the United States. The study addressed the following key question: Does the

amount of habitual glottal fry in a conversational partner influence one's use of glottal fry in their own speech?

Methods

Participants included 30 college-aged females between the ages of 18 and 29 years old ($M = 20.6$, $SD = 2.95$). Participants were recruited to participate in a “study of conversational speech” and were blinded to the specific study inquiry of glottal fry. All participants were native speakers of American English and self reported no speech, language, voice, or hearing deficits. Participants were not chosen based on their vocal qualities and therefore they represented a realistic population of college-aged females in the United States. Participants were recruited from Arizona State University (ASU) and received course credit for their involvement. Conversation partners included two female graduate students within the Speech and Hearing Sciences Department at ASU, ages 23 and 27. They were chosen for their uniquely different habitual vocal qualities: the Fry conversation partner used quantifiably significantly more glottal fry than the Non Fry conversation partner.

To determine whether the vocal qualities of the Non Fry and Fry conversation partners were acoustically significantly different, independent samples t-tests were performed, comparing the minimum, maximum, and average fundamental frequencies of both speakers, across ten conversations, with the same participants, evenly spaced throughout the course of the data collection. These values were determined first by averaging them over ten second intervals across the duration of the conversation, so that for each ten seconds a minimum, maximum, and average fundamental frequency was calculated. Control speakers were chosen under the assumption that the Fry control

speaker's voice was characterized by a lower minimum F0, higher maximum F0, and lower mean F0. As predicted, results from Welch's t-test indicated that the Fry partner had significantly lower minimum F0 than the control Non Fry partner [$t(357.102)=10.183, p<.001$]. The Fry conversation partner also demonstrated a significantly lower max pitch than the Non Fry partner [$t(428.733)=5.283, p<.001$] and an overall average fundamental frequency than the Non Fry partner [$t(372.944)=14.432, P<.001$]. Table I displays the descriptive statistics of this analysis.

The annotations of the Non Fry and Fry conversation partners were examined to evaluate whether the annotations were significantly different. Within the 30 conversations, the percentages of speech coded as speaking with fry (SF) and speaking without fry (SNF) were calculated. The percentage of SF was then compared across conversation partner using an independent samples t-test. The results showed that there was a significant effect for conversation partner, [$t(58) = 36.98, p < .001$], with Fry speaker exhibiting more glottal fry than Non Fry speaker.

Procedure

The experiment was conducted in private clinic and lab rooms within the Speech and Hearing Sciences Department at Arizona State University. Participants were seated at a table in a clinic room in front of an industry-standard microphone and TASCAM recorder. The ordered of data collection was held constant for all participants. The first control speaker conversation partner was brought into the room. The order of presentation of conversation speakers (Fry and Non Fry) were counterbalanced throughout the data collection process. The task was a seven-minute conversation about a topic chosen from the list of suggested topics, selected by the conversation pair. Topic

choices were as follows: food, hobbies, travel, entertainment, and the ASU student experience. These broad and common topics were intended to facilitate the elicitation of naturalistic conversational speech. Participants were instructed to stay close to their respective microphones throughout the duration of the experiment, and to have a back-and-forth conversational exchange in which both speakers participated by asking questions and making comments.

To close the conversation, both conversation partners were asked to complete a quick questionnaire. The questionnaire (see Appendices A and B) consisted of three questions asking about conversation satisfaction and likeability of one's communication partner. Each person answered by circling a number on a scale of one to ten, with one being Not at all, and ten being Strongly. The purpose of collecting this subjective information from each conversation was to see whether there was any significant difference between subjective satisfaction with the conversation based on conversation partner (Fry or Non Fry). The same participant then had a seven-minute conversation with the other conversational partner, and completed a similar survey at the conclusion of those tasks.

Perceptual and Acoustic Analyses

The total data set consisted of 60 conversations. Three judges performed perceptual analyses of the conversations. The judges were two graduate students in the speech-language pathology program at ASU, and one undergraduate student volunteer. Judges were trained on how to identify glottal fry by listening to samples of its creaky quality, and were given a tutorial on how to annotate in Praat 4.1. The analysis focused on three intervals of each conversation: the first, middle, and final 60 seconds. The coders

marked those intervals using three different alphabetical abbreviated codes: speaking with fry (SF), speaking without fry (SNF) and not speaking (NS). The SF label code was used when the judges perceived glottal fry, with no minimum time interval. The SNF label code was used when judges perceived the speakers' voices to be in the modal register. The NS label code was used when the judges detected silence pauses greater than half a second, as well as periods of laughter and other non-speech sounds including breath taking and mouth clicks. These perceptual annotations were saved in .textgrid format to be used for subsequent analysis. The primary judge coded the three 60-second intervals for all 60 conversations (each participant's conversation with both conversational partners). The two reliability judges (Judges Two and Three) coded 20% of the total conversations, selected randomly from the data set. A measure of interjudge reliability was calculated using a Kappa statistic. The obtained Kappa statistics were significant for the primary judge and Judge Two (0.76), and the primary judge and Judge Three (0.77), suggestive of substantial statistically significant agreement between the primary judge and others.

Once coded, the annotations and the accompanying .wav conversation file were analyzed using a manually coded Praat 4.1 script. The script automatically extracted fundamental frequency values every ten milliseconds throughout the entire sample, as well as the corresponding perceptual code assigned by the coders for those three intervals. Additionally, the script extracted jitter local and shimmer local values over ten second windows. The various dimensions of fundamental frequency, jitter local, and shimmer local were extracted to measure vocal stability. These acoustic and perceptual

values were extracted for each speaker across the 60 conversations and were analyzed via independent and paired t-test analyses.

Results

Results yielded the following two findings: (1) according to perceptual annotations, the participants used a greater amount of glottal fry when speaking with the Fry conversation partner than with the Non Fry partner, (2) statistically significant differences were found in the acoustics of the participants' vocal qualities based on conversation partner.

Analysis of the potential effects of conversational entrainment on the vocal qualities of the participants included a series of t-tests. Utilizing the previously calculated perceptual percentages of glottal fry by conversation, a paired samples t-test was performed to determine if a difference exists in the amount of glottal fry used when speaking with the Fry Speaker and the Non Fry Speaker. As anticipated, results indicated that there was a statistically significant difference, with an effect for conversation partner, [$t(29) = -4.120, p < .001$], with all 30 participants exhibiting more glottal fry when conversing with the Fry Speaker than with the Non Fry Speaker. Table II displays the descriptive statistics associated with this analysis.

The novelty of the current study lies in its use of both perceptual and acoustic analyses to assess glottal fry in conversational speech. Additional analyses were conducted on the acoustic values extracted via the custom-written Praat 4.1 script. A paired samples t-test was conducted to compare the following values taken across the speaking portions of the 30 conversations for participants: Mean F0, Standard Deviation (SD), F0 (Fundamental Frequency), F0 Range, Mean Jitter Local, SD Jitter, Min Jitter

Local, Max Jitter Local, Mean Shimmer Local, SD Shimmer Local, Min Shimmer Local, Max Shimmer. The following values were statistically significant, implying an effect for conversation partner (Non Fry Speaker vs. Fry Speaker): SD F0 [$t(29) = -2.123, p = 0.042$], Min Jitter Local [$t(29) = -2.548, p = 0.016$], Min Shimmer Local [$t(29) = -3.017, p = 0.005$] (see Table III).

Results of a paired samples t-test comparing participants' subjective survey responses to by conversation partner were not significant [$t(28) = .548, p = .588, t(28) = .451, p = .655, t(28) = .682, p = .501$]. In other words, participants rated their conversations with both the Fry and Non Fry partners very similarly. Survey responses were possibly influenced by the method of administration; further potential confounding factors are further discussed in the following section of the paper.

Discussion

The results of this study support the hypothesis that the use of glottal fry in young females is influenced by conversational entrainment. Like the transmission and perception of other indexical information in conversational speech, one's vocal register is also highly influenced by one's conversation partner(s). Even within brief seven-minute conversations with unfamiliar conversation partners, the results demonstrated quantifiable differences in the use of glottal fry and the modal register both perceptually and acoustically. This supports the notion that conversational entrainment is one explanation for the increased use of glottal fry in conversational speech amongst college aged women across the United States.

The results of the current study further support the findings of previous studies, which have confirmed the prevalence of glottal fry amongst the speech of college-aged

women at the single-word, sentence, and conversational levels (Wolk, et al., 2012; Yuasa, 2010). The current study further demonstrates that the use glottal of fry can be easily recognized by both trained and untrained judges. This ease with which glottal fry is recognized is an important component of the entrainment paradigm, as it is this perceptibility that allows conversation partners to entrain in real life.

Utilizing acoustic analyses, the current study confirmed acoustic correlates for the perception of glottal fry, demonstrated by changes in F0, jitter local and shimmer local values; this is consistent with Wolk et al.'s findings of significant changes apparent in F0 and jitter local values (2012). Together, these two studies provide quantifiable data supporting the perception of glottal fry in sentence-level and conversational speech. The current study utilized an automated script to analyze the acoustic changes over time during 60 conversations, allowing for analysis at a larger scale, and adding an important acoustic element to the perceptual presence of glottal fry. The current study demonstrated that automated acoustic analyses, rather than relying solely on the perception of the human ear, were similarly successful in detecting glottal fry as compared to the more perceptual-based analyses of previous studies (Wolk et al., 2012; Yuasa, 2010).

The current study offers a new paradigm through which to quantify and explain the increased use of glottal fry amongst young females in the United States: conversational entrainment. Results demonstrated that even in relatively brief conversations between complete strangers, utilizing participants who reflect young females living in the United States, there was quantifiable entrainment between the two interlocutors' vocal registers. Conversational entrainment, therefore, is one plausible explanation for the rise of the use of glottal fry amongst young American women, as reported both in the literature and

across popular media. Additionally, the current study utilized both perceptual and acoustic analyses to draw conclusions, rather than relying solely on judges' perceptual annotations. This approach provides quantifiable acoustic changes that correlate to perceptions of glottal fry. The naturalistic design of the current study also provides greater insight into the daily conversations occurring between young females, and uses of vocal registers in the real world, which other studies have not been able to provide by limiting the participants to more controlled vocal tasks (Wolk, et al., 2012).

While three of the acoustic correlates of glottal fry were found to be statistically significant based on conversation partner, these results must be interpreted with caution as the standard deviations cause the values to overlap. Additionally, not all acoustic correlates of glottal fry were significant for participants based on conversation partner. These contraindications of significance may be due in part to the sampling method, as the Praat script extracted values over the entire conversation, yielding a substantial amount of data points. Future analyses should be consistent with calculating the acoustic values over the same three intervals that were perceptually annotated, as a way of analyzing perceptual and acoustic presence of glottal fry over the same ranges.

Further exploration into the relationship between conversational satisfaction and level of entrainment (i.e. use of glottal fry) is warranted. The use of subjective questionnaires completed by both conversation partners following each conversation could be better introduced via a method that would allow the individuals greater amounts of privacy, which could yield more honest and potentially more accurate responses. It is also possible that the participants' responses to the surveys were influenced by their familiarity with glottal fry in their daily lives; perhaps their ratings of the two

conversations were similar because both speakers' vocal qualities sounded typical to them. The analysis of conversational entrainment and the use of glottal fry could further be explored in a turn-by-turn fashion, wherein researchers analyze where and how glottal fry is used in conversational speech. The participant pool could further be expanded to include participants living in areas across United States, rather than one concentrated geographic location, to assess whether the use of glottal fry is possibly further influenced by regional location.

While the purpose of the current study was not to analyze the deeper psychological and sociolinguistic motivations for and implications of using glottal fry, this is certainly an area of interest to sociolinguists. Yuasa (2010) reported that judges from different parts of the country perceived women who spoke with glottal fry to represent favorably, representing an "urban-oriented," "upwardly mobile" identity. Meanwhile, another study by Anderson, et al. (2014) demonstrated that glottal fry in females' speech is perceived negatively and could be potentially harmful to employment prospects. While the current study demonstrates that young women are indeed speaking in glottal fry in everyday conversations, and that its use can be attributed in part to conversational entrainment, we still lack a clear explanation of the deeper motivations for women to speak in a lower vocal register. What does it portray, and why is it so commonly used? Across which situations and with which conversation partners do women utilize glottal fry most? Where does it occur in utterances across conversational speech and how does it impact the greater meaning of the message? How is glottal fry used by the male gender and are males equally susceptible to glottal fry through conversational entrainment? These

inquiries, among others, are potential areas of future research that would allow us greater insight into this sociolinguistic trend.

TABLE I.

Descriptive Statistics of the Fry and Non Fry Conversation Partners

Variable	Mean Value	N	SD	Std. Error Mean	t	Sig.
Min. F0						
Fry Sp.	84.5 Hz	222	23.58 Hz	1.582	10.183	.000
Non Fry Sp.	116.4 Hz	222	40.17 Hz	2.69		
Max. F0						
Fry Sp.	352.8 Hz	222	128.18 Hz	8.60	5.283	.000
Non Fry Sp.	412.06 Hz	222	107.30 Hz	7.20		
Avg. F0						
Fry Sp.	187.48 Hz	222	34.56 Hz	2.32	14.432	.000
Non Fry Sp.	227.06 Hz	222	21.81 Hz	1.46		

TABLE II.

Percentage of Glottal Fry Speech with Fry vs. Non Fry Conversation Partners

Conversation Partner	Mean % of Glottal fry Speech	N	Standard Deviation	Standard Error Mean	t	Sig.
Non Fry Speaker	.196360	30	.1129951	.0206300	-4.120	< .001
Fry Speaker	.292418	30	.1767935	.0322779		

TABLE III.

Descriptive Statistics of Participants' Speech Across Conversations with Fry and Non Fry Speakers – **add t value and significance columns**

Conversation Partner	Value	Mean	N	SD	t	Sig.
Non Fry Sp.	Mean F0 (Hz)	222	30	18.810	-0.417	0.68
Fry Sp.		223	30	25.322		
Non Fry Sp.	SD F0 (Hz)*	62	30	11.152	-2.123	0.042
Fry Sp.		67	30	12.435		
Non Fry Sp.	F0 Range (Hz)	519	30	8.2145	0.833	0.412
Fry Sp.		510	30	58.178		
Non Fry Sp.	Mean Jitter Local (%)	0.0182	30	0.0035	-1.431	0.163
Fry Sp.		0.0193	30	0.0035		
Non Fry Sp.	SD Jitter Local (%)	0.0129	30	0.0064	0.092	0.927
Fry Sp.		0.0128	30	0.0061		
Non Fry Sp.	Min Jitter Local (%)*	0.0036	30	0.0016	-2.548	0.016
Fry Sp.		0.0046	30	0.0016		
Non Fry Sp.	Max Jitter Local (%)	0.0831	30	0.0501	0.899	0.376
Fry Sp.		0.0734	30	0.0426		
Non Fry Sp.	Mean Shimmer Local	0.0953	30	0.0151	1.558	0.13
Fry Sp.	(dB)	0.0906	30	0.1397		
Non Fry Sp.	SD Shimmer Local	0.0380	30	0.0069	-0.702	0.488
Fry Sp.	(dB)	0.0391	30	0.0063		
Non Fry Sp.	Min Shimmer Local	0.0374	30	0.0095	3.017	0.005
Fry Sp.	(dB)*	0.0318	30	0.0097		
Non Fry Sp.	Max Shimmer Local	0.2295	30	0.0460	-1.168	0.252
Fry Sp.	(dB)	0.2448	30	0.0605		

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APPENDIX A

POST-CONVERSATION QUESTIONNAIRE: FRY PARTNER

Note: This is a completely anonymous questionnaire. Its sole purpose is to collect subjective feedback about your conversational experience. Your answers are kept confidential and are not shown to your conversation partners. Please answer honestly and thoughtfully.

On scale of 1-10, how much would you like to talk to _____ again?

1 2 3 4 5 6 7 8 9 10
Not at all Neutral Definitely

On a scale of 1-10, how satisfying was your conversation with _____?

1 2 3 4 5 6 7 8 9 10
Completely Neutral Very satisfying
unsatisfying

On a scale of 1-10, how well did you feel you connected with _____, considering you had never met before?

1 2 3 4 5 6 7 8 9 10
Not at all Neutral Connected strongly

APPENDIX B

POST-CONVERSATION QUESTIONNAIRE: NON-FRY PARTNER

Note: This is a completely anonymous questionnaire. Its sole purpose is to collect subjective feedback about your conversational experience. Your answers are kept confidential and are not shown to your conversation partners. Please answer honestly and thoughtfully.

On scale of 1-10, how much would you like to talk to _____ again?

1 2 3 4 5 6 7 8 9 10
Not at all Neutral Definitely

On a scale of 1-10, how fulfilling was your conversation with _____?

1 2 3 4 5 6 7 8 9 10
Completely Neutral Very fulfilling
unfulfilling

On a scale of 1-10, how much did you feel you had in common with _____, considering you had never met before?

1 2 3 4 5 6 7 8 9 10
Not at all Neutral Got along very well